

**CLAIMS**

What is claimed is:

1. A method of reducing warranty costs, comprising:

5 discriminating between a hardware-induced problem or outage and a software-induced problem or outage in a computer system.

2. The method of claim 1, further comprising:

periodically storing indicators of system software and hardware health prior to the problem or outage.

3. The method of claim 2, further comprising:

10 after the problem or outage, analyzing those indicators to determine whether the problem or outage was due to hardware or software.

4. The method of claim 3, further comprising:

presenting information regarding a cause of the problem or outage to a user of the computer system to prevent an unnecessary service call and hardware replacement.

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5. The method of claim 1, further comprising:

depending upon said determining of said hardware-induced problem or outage or said software-induced problem or outage, determining a

manufacturer of said hardware or said software having undergone said problem or said outage.

6. The method of claim 1, wherein, in event of an outage of one of said hardware and software, pre-outage data is stored in a log file across the outage.

7. A method of reducing warranty costs associated with a computer system, comprising:

detecting a lack of performance of said computer system; and

discriminating whether said lack of performance was caused by a

hardware-induced problem or a software-induced problem.

8. The method of claim 7, further comprising:

gathering pre-lack of performance data, said discriminating being performed based on said pre-lack of performance data.

9. The method of claim 7, further comprising:

recovering from said lack of performance.

10. The method of claim 8, wherein said lack of performance comprises an outage, and in event of an outage of one of said hardware and software, said pre-outage data is stored across the outage.

11. A method of reducing warranty costs, comprising:

discriminating between a hardware-induced problem or outage and a software-induced problem or outage in a computer system; and

5 based on said discriminating, reducing a duration of a service call and ensuring that a service technician has a correct part on hand at a time of repair.

12. The method of claim 11, further comprising:

periodically storing indicators of system software and hardware health prior to the problem or outage.

13. The method of claim 12, further comprising:

10 after the problem or outage, analyzing the indicators to determine whether the problem or outage was due to hardware or software and which hardware or software subsystem was most likely a cause of the outage, and to produce information.

14. The method of claim 13, further comprising:

15 presenting the information to a service technician of a computer system to replace or repair a faulty subsystem.

15. A method of reducing a trouble-shooting cost in a computer system, comprising:

20 sampling system health data from a plurality of sources, and storing said data in a log;

determining whether an outage event has occurred; and

based on whether an outage event occurs, analyzing logged and other data to judge a likely cause of the event.

16. The method of claim 15, wherein if the event is judged to be due to software, determining whether automatic recovery is possible, and if so, invoking an automatic recovery mechanism and notifying a customer or field support personnel that a software problem is the cause of the event, and identifying a faulty subsystem for subsequent troubleshooting.

17. The method of claim 15, wherein if the event is judged to be due to software, determining whether automatic recovery is possible, and if not, then indicating that the event is due to software, and is not automatically recoverable, and notifying a customer or service technician to manually recover the fault.

18. The method of claim 15, further comprising:

determining whether the event is a software fault and if not, then determining whether a diagnosable hardware fault exists.

19. The method of claim 18, further comprising:

if the event is judged to be caused by hardware, then examining at least one of a hardware error log, an error register, and a hardware diagnostic, and attempting to localize a replaceable component that caused the event;

informing a customer or a service technician that the outage was due to hardware; and

manually recovering the hardware by replacing only defective hardware.

5        20. A computer node associated with a computer system, comprising:

hardware for executing an operating system, at least one application program, and a system health monitoring program,

10        wherein said system health monitoring program gathers system software and hardware health data from an application program, an operating system, and the hardware, and discriminates a cause of an event comprising at least one of a problem or outage of said computer node.

21. The computer node of claim 20, wherein said computer node includes sources of information for assessing software and hardware health.

15        22. The computer node of claim 21, wherein said information is measured and logged prior to a failure event,

said system health monitoring program monitors at least one of resource consumption data, system and application software error logs, system utilization and performance data, and software error counts.

20        23. The computer node of claim 20, wherein said system health monitoring program monitors at least one of concurrent diagnostics, hardware error logs, and hardware error counts, and

wherein said system health monitoring program gathers information after the event, including at least one of error logs, crash dumps of memory, error codes, offline or power-on hardware diagnostics, and hardware error registers.

24. The computer node of claim 20, wherein said system health monitoring program includes a log device for permanently storing a time history of system software and hardware health data, said log device being readable after an event to determine a likely cause of the event.

25. The computer node of claim 20, wherein said system health monitoring program includes an analyzer for analyzing the software and hardware health data.

26. The computer node of claim 25, wherein said analyzer is run on the computer system that has experienced a problem, or on another execution environment.

27. The computer node of claim 20, wherein said system health monitoring program includes a notifier for notifying a customer or field service support personnel regarding a cause of the outage or problem, whether a service call is necessary, and where the likely cause of the outage or problem resides.

28. The computer node of claim 20, wherein said system health monitoring program samples a plurality of parameters, said plurality of parameters including at least one of:

5 a parameter indicating a number of bytes that must be kept in physical memory and cannot be paged out to disk;

a parameter indicating a number of bytes that reside in said physical memory plus the paging files;

a parameter indicating a number of errors that have been reported by transmission control protocol (TCP)/Internet Protocol (IP) software; and

10 a parameter indicating whether said TCP errors are accompanied by Network Adapter Errors.

29. A system for use with a computer system, comprising:

an outage detector for detecting and outage;

15 a memory for storing pre-outage data of the system; and

a discriminator for discriminating whether said outage was caused by a hardware component or a software component of said system.

30. The system according to claim 29, wherein, in event of an outage of one of said hardware and software, said pre-outage data is stored across the outage.

20 31. A signal-bearing medium tangibly embodying a program of machine-readable instructions executable by a digital processing apparatus to perform a method for reducing warranty costs, said method comprising:

discriminating between a hardware-induced problem or outage and a software-induced problem or outage in a computer system.

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